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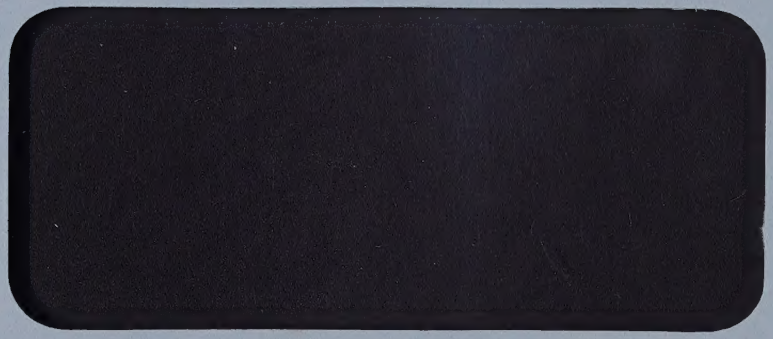
WAYNE KERR

105/CA 1442

PORTABLE V.H.F. FREQUENCY STANDARD FS 100

INSTRUCTION MANUAL



MP MASTER

MA24516

PORTABLE V.H.F.
FREQUENCY STANDARD
FS 100

INSTRUCTION MANUAL

The Wayne Kerr Laboratories Ltd.,
Coombe Road, New Malden,
Surrey, England.

Telephone: MALden 2202

Telegraph: WAYNKERR, New Malden.

Wayne Kerr Corporation,
1633 Race Street, Philadelphia 3,
Pennsylvania, U.S.A.

Telephone: LOcust 8-6820

Telegraph: WAYNKERR, Philadelphia.

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Fig. 1 Trimmer Location.....Facing Page 9

Circuit Diagram

INTRODUCTION

This portable instrument enables accurate checks to be made on the operating frequency of mobile v.h.f. transmitters and receivers.

It consists of a crystal-controlled oscillator, frequency multipliers, a wide-band mixer, an a.f. oscillator, an a.f. amplifier, and all rectifying and smoothing circuits for operation from a.c. supplies of 90 to 140 volts and 180 to 250 volts.

Up to six thermostatically-controlled plug-in ovens can be fitted and each is capable of housing two crystals. A twelve-position switch connects one of these crystals into an aperiodic Colpitt's oscillator circuit.

The fundamental frequency of the crystal, and frequency multiples of x 3, x 9 and x 18, are then available at front-panel sockets. Crystals can be selected for operation at any frequency in the range 6.7 to 7.5 Mc/s. The x 3, x 9 and x 18 outputs corresponding to these limits provide ranges of 20.3 to 22.5 Mc/s, 60.9 to 67.5 Mc/s and 135 to 175 Mc/s respectively. It should be noted that these ranges do not rely on the use of any harmonic present in the output from the Frequency Standard. When harmonics are employed, checks can be made over much wider ranges although the effective voltages available will be much less than over the ranges quoted above.

It is not practicable to provide a single multiplier channel covering the full frequency ranges. Consequently two types of multiplier unit are used, each covering parts of the range.

The voltage available at any output socket is adequate for checking receivers. When transmitter frequencies are being checked, a signal derived from the transmitter is fed into the Frequency Standard and the beat note, from the mixer and amplifier, is available at a jack socket on the instrument for head-phones.

The 15 kc/s oscillator is used to modulate the output signal when required to give a signal ± 15 hc/s displaced from the centre frequency.

A chart on the back of the FS100 shows the crystal frequency for each setting of the selector switch.

A waterprood carrying case, internally quilted and with a webbing shoulder-strap, is available as an accessory.

SPECIFICATION

Basic Fr
Covei

MULTIPLIER	SUITABLE CRYSTALS Mc/s	OUTPUT FREQUENCY (Mc/s) x 3	x 9	x 18
Band 1	6.7 - 7.0	20.3 - 21.3	61 - 64	122 - 128
Band 2	7 - 7.5	21 22.5	63 67.5	128 - 134

Frequency Stability: After a 45-minute warming-up time, the variation in the crystal frequency and the corresponding multiples is not graater than ± 3 parts per million.

Voltage Output: Into a load of 400 ohms:

x 1 output Not less than 1·5V

x3, x9, x18 Not less than 1mV

TX Socket: Voltage required: not less than 1mV.

Input impedance approximately 5kΩ.

Oven Temperature: Thermostatically-controlled at 80°C.

Temperature variation less than ± 1°C.

Head-phone Jack Socket: Intended primarily for 2000-ohm headphones but 600-ohm headphones can be used (resulting in slightly reduced sensitivity).

Power requirement: 90 to 140 volts or 180 to 250 volts, 40-60c/s. Taps provided at 10-volt intervals (accessible when rear panel is removed).

Consumption approximately 80 watts maximum (dependent on number of ovens in operation).

Dimensions: 13 1/4" wide x 9" high x 8 1/4" deep.
(33·6 x 22·9 x 21 cm)

Weight: 16 lb (7·3 kg).

Initial Adjustments

1 Remove the rear panel and check that the transformer tapping selected is the nearest one to the supply voltage. Taps are provided for 100, 110, 120, 130, 190, 200, 210, 220, 230 and 240 volts, 40-60 c/s.

2 Check that, in any position where no multiplier unit is fitted, there is a moulded connecting block inserted. The instrument cannot operate correctly if any of the three positions is left blank.

3 Connect the power cable to a suitable plug as follows:

Green Wire	Earth
Black or Blue	Neutral
Red	Live

Normal Operation

No on/off switch is provided on the instrument: this is to prevent accidental interruption of the thermal stability. Consequently, when the instrument is connected to the power, the valve heaters, the oven indicating lamps and the oven heating elements are all operative.

1 Refer to the chart on the back of the instrument and turn the selector switch to the desired crystal.

2 Push the appropriate 'Band' switch.[x] The selection depends

[x] Do not operate more than one 'Band' switch at once or the rectifying circuits may be damaged by overloading.

on the frequency of the crystal in use: the coverage of each band is given in the Specification.

3 Allow a 45-minute warming-up time, during which the oven lamps should be seen to switch on and off as the thermostats operate. The black HT button operates a push-on/push-off switch. It is provided to permit some economy of valve life and current consumption to be obtained during periods of non-use: it can be in the 'off' position (i.e. out) during the warming-up period.

4 Press in the black HT button to the 'on' position. The instrument is now ready for operation.

5 Switch off the HT whilst selecting a new band or channel.

Receiver Checks

The exact procedure for checking the crystal frequencies on V.H.F. transmitter/receivers will normally be described by the manufacturers of the receiver and this should be adhered to. An extremely valuable method for accurate checks is to use the FS100 to supply an accurate carrier frequency and to beat the intermediate frequency as produced in the transmitter/receiver with an additional signal from a separate oscillator operating at the intermediate frequency itself. A small tolerance on the frequency accuracy of the external oscillator is proportionately a very much smaller tolerance on the crystal frequencies being checked in the transmitter/receiver.

The most convenient method of injecting the external i.f. signal is to use a short length of wire, acting as an aerial, near the i.f. stages of the receiver.

is a self-contained crystal-controlled t[illegible] (3 x 2 x 1 inches including internal battery) providing a fi[illegible] frequency output between 2 and 6 Mc/s. The oscillator, and fully descriptive literature, is available [illegible] the manufacturers or Wayne Kerr.

Transmitter Checks

To check the tuning of transmitters a signal must be applied to the TX sockets of the FS100. This signal must be so derived from the transmitter output that the level is greater than 1 millivolt, but care must be taken not to apply the full power output or the germanium rectifier in the wide-band mixer amplifier may be permanently damaged. High impedance (e.g. 2000-ohm) headphones should be plugged into the jack socket provided and the transmitter crystal trimmer adjusted until the beat note is brought to zero, at the mid-point of the oven temperature cycle.

15 kc/s Oscillator

The 15 kc/s oscillator is switched on, when required, by pressing the white switch knob mounted on the right hand side of the front panel.

Replacement of Multiplier Units

1 Lay the FS100 on its back, undo the four screws in the corners of the front panel and lift the instrument from its case.

2 The multipliers are held in position by two screws from the underside of the chassis. To disconnect a multiplier unit, first remove the t o set-screws and then ease the

unit carefully up from the chassis. The multiplier units, and the moulded connecting blocks, have non-reversible bases. It is important to check that the correct positioning has been found before pushing either into position. The holders for Band 1, Band 2, and Band 3 multipliers are labelled and in every position there must be either a multiplier unit or a moulded connecting block.

3 Replace the instrument in its case.

Replacement of Ovens or Crystals

NOTE Access to the ovens and crystals can be obtained by removing the rear panel, but the procedure is facilitated if the instrument is removed from its case.

1 Lay the FS100 on its back, undo the four screws in the corners of the front panel and lift the instrument from its case.

2 Release the spring clip from the oven to be removed and pull in a straight line away from the holder. This will expose the crystals and these can be removed by a straight pull.

3 Fit the desired crystals and replace the ovens, noting that they are non-reversible, the pin spacing being unequal on the two sides.

4 Replace the instrument in its case.

5 If crystals have been changed, the associated trimmers must be adjusted, as described below. If a change in the frequency of operation of any channel is made, the card on the back of the instrument should be amended accordingly.

Replacement of Oven Pilot Lamps

1 Turn the selector switch to position 1.

2 Unscrew (counter-clockwise) the coin-slotted metal centre of the selector knob, and remove it.

3 Push the knob towards the front panel, rotate it by 90 degrees (to position 4 or 10) and draw it off the spindle.

4 Remove the two 6 B.A. screws exposed.

5 Remove the numbered disc.

6 Two spare lamps are provided, they are in positions 10-11 and 2-3. Substitute one of these for the faulty lamp.

7 Re-fit the numbered dial and the two 6 B.A. screws.

8 Replace the knob, turn to position 1, and re-fit the metal centre. Whilst tightening the latter, check that the knob is correctly located by pulling it away from the panel.

IMPORTANT: The foregoing instructions should be followed carefully as otherwise the knob may be re-fitted incorrectly (by 180 degrees).

Adjustment of Crystal Trimmers

NOTE: Trimmers are provided to permit adjustment of the crystal-holder capacitance and associated wiring capacitance to the value recommended for the crystals used (normally 30pF). These trimmers effect a very fine control on the frequency of oscillation and, before the instrument is put into service, they must be adjusted. The procedure is described in the next paragraph. When the instrument is supplied with crystals specified by the user, the trimmer adjustment is made at the Works and no further attention is necessary.

Connect the x1 output from the FS100 to a frequency counter or similar equipment and adjust the appropriate trimmer (see Fig. 1) to set the frequency to the exact value required. Repeat the procedure for all crystals fitted.

WARNING: The d.c. supply for the transistor amplifier is derived from the h.t. current to the remainder of the Frequency Standard. Consequently it is essential that the main h.t. supply current must never exceed the normal value (caused, for instance, by momentary short-circuits) or the transistors may be damaged.

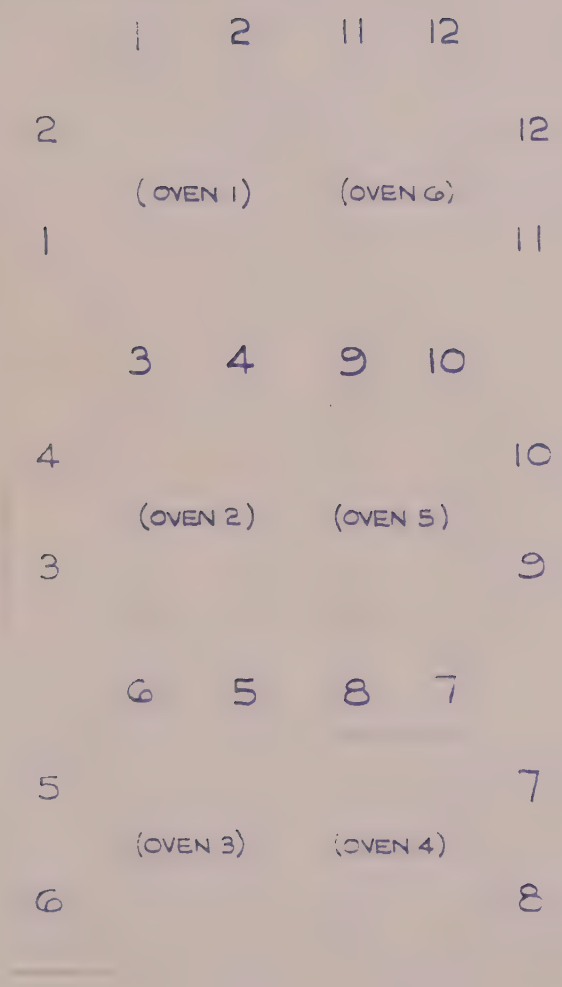
1 2 11 12
2 12
(OVEN 1) (OVEN 6)
1 11
3 4 9 10
4 10
(OVEN 2) (OVEN 5)
3 9
6 5 8 7
5 7
(OVEN 3) (OVEN 4)
6 8

FIG. 1

MULTIPLIER UNIT BAND 1 FREQUENCY RANGE 122-128 Mc/s

MULTIPLIER UNIT BAND 2

FREQUENCY RANGE 128-134 Mc/s

CIRCUITRY AS MULTIPLIER UNIT BAND 1

MULTIPLIER UNIT BAND 3

CIRCUITRY AS MULTIPLIER UNIT BAND 1

LINE

NEUTRAL

EARTH

FS1
2·5A WITH 100-130 V.A.C.
1·0A WITH 190-240 V.A.C.

S1A S1B

S2
PUSH FOR ON
PUSH FOR OFF

HT

T1 T2 T3 T4 T5

V1 6X4

V2A V2B 6U8

V3 QS 150/15

V4 V5 EF91

V6A V6B 6U8

OVEN 1 OVEN 2 OVEN 3 OVEN 4 OVEN 5 OVEN 6

LP1 LP2 LP3 LP4 LP5 LP6

SKT 1 SKT 2 SKT 3 SKT 4 SKT 5 SKT 6 SKT 7 SKT 8 SKT 9

PL1 PL2 PL3 PL4 PL5 PL6 PL7 PL8

S3A S3B S3C

TO HEATERS V4-V6

12V TO SKTS. 4-9

6·3V TO HEATER V2

12 V

BAND 1 BAND 2 BAND 3

TR1 TR2 TR3 TR4 TR5 TR6 OC71 2S304

MR1 MR2 152120A

TH1 TH2

J1

S4

TX x1 x3 x9 x18

MODIFIED FOR MOA REQUIREMENT A 7-5-62

CERTIFIED ISSUE DATE

WAYNE KERR DRAWING NUMBER D.6965

MATERIAL

PROTECTIVE FINISH

TOLERANCES
FRACTIONS ± 1/64
DECIMALS ± ·005
UNLESS OTHERWISE STATED

DIMENSIONS IN INCHES

SURFACE ROUGHNESS

SCALE FULL SIZE

THE WAYNE KERR LABORATORIES LIMITED

SERVICE LETTERS

TITLE

FREQUENCY STANDARD F.S.100
CIRCUIT DIAGRAM

MP MASTER
MA24516